tion of fish culture appliances showing the process of hatching, the mode of dealing with the fry after losing their umbilical sac, and the best means of artificially feeding them until they have reached that stage in their existence when they are able to provide for themselves. A special building is to be erected for this purpose in proximity to the aquarium, which is now in course of construction. This section of the Exhibition, which will be under the entire direction of the National Fish Culture Association, promises to be a source of much attraction and interest to the ichthyological world.

An experiment has lately been tried by the Secretary of the National Fish Culture Association at South Kensington to test the highest temperature endurable by various species of fish. To this end several specimens of the following fish were selected for the trial, viz. the carp, gudgeon, dace, roach, perch, minnow, golden tench, common tench, trout, and salmon, all of which were deposited in cold water registering 53°. The temperature was then gradually increased by the infusion of hot water through a tube which caused the temperature to rise steadily. None of the fish, however, exhibited signs of fading vitality until the thermometer recorded 82°, when a perch became prostrated; and shortly afterwards its congeners followed its example in rapid succession in the following order:—Roach, 82½°; salmon, 83°; minnow, 85°; gudgeon, 85½°; dace, 86°; common tench, 88°; golden tench, 88°; carp, 91°.

So as to further test the efficacy of brandy as a fish restorer, about which much has lately been said, each fish on showing signs of exhaustion was removed from the water, dosed with a small quantity of brandy, and replaced in the tanks from whence it was taken. The operation proved highly successful, for on inspection the following day all the objects of the experiment were found swimming about as usual, and thoroughly restored to their normal exuberance, with the exception of the dace, which succumbed to the severe ordeal through which it had passed.

The additions to the Zoological Society's Gardens during the past week include a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Mr. F. W. Robinson; a Royal Python (*Python regius*) from West Africa, presented by Mr. A. H. Berthoud; a Long-eared Owl (*Asio otus*), British, presented by Mr. R. Farren; two Kagus (*Rhinochetus jubatus*) from New Caledonia, purchased.

GEOGRAPHICAL NOTES

In a special article communicated to the *New York Tribune*, Lieut. Greely unfolds his views upon future Arctic exploration. Of the five well-known routes to the Pole, he advocates the Franz Josef route as the only probable one. Lieut. Greely shows by all the experiences of Arctic travellers, from Sir Edward Parry downwards, that continuity of land, with northern trend and western aspect, and a secure harbour easy of access, together with good ice for sledging operations, are necessary desiderata for Arctic exploration. He maintains that all these conditions are fulfilled in the fifth route—viz. that by Franz Josef Land. "This route," continues Lieut. Greely, "presents unusual chances of success with the minimum of danger. It is more than possible that an English expedition will enter these waters. Chief Engineer Melville, U.S.N., has in view an expedition by this route, and his varied Arctic experiences and indefatigable energy mark him as a man peculiarly fitted for this work. It is therefore to be hoped that he will be given the desired opportunity. Two ships with about sixty men and officers would be needed. One vessel should winter in Eira Harbour or some secure point near by, while the second should be pushed as far northward as possible, preferably by Austria and Rawlinson's Sounds, but, if that is not possible, along the west coast of Franz Josef Land beyond Cape Ludlow. The vessels should be provisioned for three years, and the crews should be quartered in temporary houses to be erected on shore. August and September there, as in Smith Sound, are undoubtedly the most favourable months for ice navigation. In case of a bad year for ice the vessels should rather return, to renew the expedition the year following, than adventure the experiences of the *Tegethoff*. After full suggestions and recommendations as to the command and outfit of the expedition, covering every branch of the subject, the writer expresses a doubt whether the United States Government will extend any aid to Arctic exploration for years to come, but none the less does he believe in the propriety and certainty of future Arctic work. In concluding his article Lieut. Greely says:—"The expedition suggested by Lieut. Ray, United States Army, at the meeting of the British Association at Montreal, should receive the attention and support of scientific men. The magnetic pole of Boothia Felix Land, located by Ross in 1831, has probably changed its position in the past fifty years. Its re-location would be an important contribution to science. With a home station at Repulse Bay or in Wager River, I believe this work could be done without great expense or serious danger. The benefits to be derived from such an expedition would not be confined to terrestrial magnetism. As regards ethnology, botany, and natural history, the country around King William Land is substantially a blank."

An interesting account of recent Norwegian explorations in the Spitzbergen Seas will be found in yesterday's *Times*. Several new islands have been discovered to the east of King Karl or Wiche Land. These explorations show that the year 1884 was a very remarkable ice-year. The west side of Spitzbergen was blocked by a belt of land-ice the whole summer through, while the east side, which is nearly always blocked with ice, was more open than it has been for many years. These conditions, there seems little doubt, depend on the prevailing direction of the winds.

According to the *American Naturalist* three expeditions have been despatched during the last summer to explore the lake region reported to exist in the north-eastern part of the provinces of Quebec and in Labrador. One went by way of Lake St. John, another by the River Betsiamits, and a third from Newfoundland. The last has orders to land scientific observers at various points upon the coast of Labrador, where they will spend the winter. Little that is definite appears to be as yet known respecting the actual dimensions of Lake Mistassini and other bodies of water in this region. A French missionary, writing in 1672, says that this lake is "believed to be so large that it took twenty days to walk around it." Mr. Burgess affirms that it is 150 miles in length, and abounds in deep bogs. An old trader of the "Compagnie des Postes du Roi," who was stationed on it for several years, estimated its least width at ninety miles. The account of 1672 mentions another lake, "ten days' round, and surrounded by lofty mountains." These lakes appear to occupy a depression similar to that occupied by Lakes St. John, Temiscaming, and many smaller lakes to the southward, and Silurian limestone has been observed in Lake Mistassini as well as at Lake St. John. The former lake is supposed to be about 1300 feet above the sea, and the land between it and Lake St. John to the south is only 300 feet above the sea. The plain around it is said to be very fertile, and attention has recently been called to the magnificent forests and fertile soil of the country around Hudson's Bay to the north of it. The explorations now in progress will doubtless open up extensive areas for colonisation, besides adding largely to our geographical knowledge.

La Gazette Géographique announces the death, in Tonquin, of M. Stocker, who perished recently in an expedition against the Muongs on the Red River. M. Stocker, who was a native of Alsace, travelled for thirty years in the United States, having explored specially the Rocky Mountains and the territory of Alaska. He returned recently from California to France, and was despatched by the Government to investigate the mineral wealth of Tonquin, where he discovered the auriferous deposits of Myduc. His reports on the subject were not encouraging for the development of mining enterprise there, as he declared that the value of the mines had been greatly exaggerated. He was shot dead during one of the skirmishes in the Muong expedition.

Sixteen "*brigades topographiques*" embarked at Marseilles on January 31, fourteen for service in Algeria and two in Tunis. These brigades are under the command of an officer, of an engineer, and of an official of the geographical department of the War Office in Paris. The whole include seventy-two officers, each accompanied by two soldiers and a native sharpshooter.

The instruments, provisions, and tents for each officer are to be conveyed on a horse and four mules. They will commence their surveying work in the south of each of the three Algerian provinces, and their position, scattered as they will be singly over the whole of Algeria, in the midst of semi-subjugated tribes, will be a delicate and perilous one. They will probably return to Paris about the end of May.

AT the last meeting of the Geographical Society of Paris it was stated that Col. Prejevalski had discovered the sources of the Yang-tsze-kiang.

THE last number of the *Boletin de la Sociedad Geográfica de Madrid* contains a first instalment of Capt. Eduardo O'Connor's official report on his recent exploration of the Upper Limay (Rio Negro) and Lake Nahuel-Hualpi. This report is of considerable geographical interest, as it embodies a detailed account of the first successful attempt to navigate the Rio Negro, from its mouth in the Atlantic to its source in the romantic Lake Nahuel-Hualpi in the heart of the Chilian Andes. As far as the Colluncurá (Catapuliche) confluence the expedition was able to proceed on board the *Rio Negro* steamer, but beyond that point it had to make its way in an open boat, which had in many places to be hauled over the numerous rapids obstructing the navigation of the Upper Limay, or furthest southern head-stream of the Rio Negro. Here the river flowed mainly in a narrow rocky bed, contracting at some points to 120 and even 100 feet, with a current varying from seven to nine, and even eleven miles an hour at the most difficult rapids. But beyond the confluence of the Treful, in 40° 42′ S. lat., the reefs and other obstructions disappeared, the current fell to a mean velocity of five or six miles, and as the stream is very deep it would be accessible to steam launches in this section all the way to the lake. Approached from the Limay this alpine basin presented a charming prospect, winding away to the right in an endless series of rocky inlets or wooded creeks, opening out to the left in broad and slightly undulating grassy savannahs. The hills rise in some places to a height of 700 or 800 feet above the lower wooded slopes, breaking into sharp peaks, crags of fantastic shape, or rocky walls, as uming here and there the appearance of cyclopean fortifications. The horizon was bounded in the distance by an extensive range of lofty sierras covered with snow, and like the lower hills often assuming the most varied and capricious forms. The deep blue waters of the lake are broken only by a solitary island of large size covered with dense vegetation, and intersected by regular ranges of hills from 300 to 400 feet high. The surrounding country appears to be uninhabited, and on calm days, rare in this breezy region, all nature is wrapped in the stillness of death, and the glassy surface of the lake unbroken by a single ripple.

ASTRONOMICAL PHENOMENA FOR THE WEEK, 1885, *FEBRUARY* 15–21

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on February 15

Sun rises, 7h. 16m. ; souths, 12h. 14m. 20·3s. ; sets, 17h. 13m. ; decl. on meridian, 12° 30′ S. : Sidereal Time at Sunset, 2h. 56m.

Moon (New at 2h.) rises, 7h. 6m. ; souths, 12h. 29m. ; sets, 18h. 0m. ; decl. on meridian, 8° 9′ S.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on Meridian ° ′
Mercury ...	6 44	11 1	15 17	19 47 S.
Venus ...	6 36	10 57	15 18	19 5 S.
Mars ...	7 20	12 12	17 4	13 49 S.
Jupiter ...	17 28*	0 35	7 42	12 8 N.
Saturn ...	11 18	19 21	3 25*	21 34 N.

* Indicates that the rising is that of the preceding, and the setting that of the following nominal day.

Occultation of Star by the Moon

Feb.	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image
			h. m.	h. m.	° °
20 ...	38 Arietis ...	5 ...	19 41 ...	20 1 ...	211 246

Phenomena of Jupiter's Satellites

Feb.	h. m.		Feb.	h. m.	
16 ...	6 20	I. ecl. disap.	19 ...	0 25	I. tr. egr.
	19 21	III. ecl. disap.		19 15	I. occ. disap.
	23 9	III. occ. reap.		20 41	IV. ecl. reap.
17 ...	3 40	I. tr. ing.		21 34	I. occ. reap.
	6 0	I. tr. egr.		23 38	II. tr. ing.
18 ...	0 49	I. ecl. disap.	20 ...	2 33	II. tr. egr.
	3 8	I. occ. reap.		18 51	I. tr. egr.
	5 22	II. ecl. disap.	21 ...	18 32	II. occ. disap.
	22 6	I. tr. ing.		21 33	II. ecl. reap.

The Occultations of Stars and Phenomena of Jupiter's Satellites are such as are visible at Greenwich.

Feb.	h.	
15 ...	4 ...	Mars in conjunction with and 4° 30′ south of the Moon.
17 ...	1 ...	Saturn stationary.
19 ...	8 ...	Jupiter in opposition to the Sun.

CATALOGUE OF EARTHQUAKES[1]

THE importance of earthquakes as factors in geology tends to be more and more appreciated, and the seemingly increased seismic activity so strongly manifested in different quarters of the globe during the last few years has greatly stimulated the interest in, and the study of, these wonderful phenomena. Amongst many contributions to this branch of geology, have appeared quite recently, this catalogue and map, of which we have given the title, and which have followed other papers by the same author relative to this series of phenomena, published in the *Proceedings* of the Royal Irish Academy.

The earthquake catalogue and map now given by Prof. O'Reilly is based upon a very interesting relation of jointing and fissuring to the physical geography of a country, but more particularly to the coast-line directions. This relation he has shown to be very marked for the east coast of Ireland (see *Proc. Roy. I. Acad.*, 2nd series, vol. iii. ; *Science*, No. 8, May, 1882, and vol. iv. ; *Science*, No. 2, 1884) ; and, considering that much of the fissuring of the earth-surface is mainly due to earthquake action, he looks upon the systems of jointing and fissuring of a country, and consequently their correlated coast-lines, as so many records of past earthquake action ; the only ones, in fact, left us in many cases, and (taking into consideration the poverty and meagreness of historical records in this respect) the most valuable records of these phenomena we have extant. On the other hand, the lists of Mallet, Perrey, Fuchs, &c., present earthquakes in a purely chronological order, are difficult to consult and but little accessible, and in them the events stand out independently, and to a very great extent without apparent connection one with the other, while we know that geological change is the result of a sum of actions taking place continuously in certain localities, and extending through immense durations of time. It has seemed to the author of the present "Catalogue" that it would be useful to present the earthquakes of the three kingdoms in a summarised and connected form, and for that purpose arranged alphabetically, so that it may be possible to ascertain for a given point or locality the sum of earthquake action having occurred therein during historical time. The "Catalogue" thus formed merely gives the years of occurrence for a given place or district, and in this manner indicates frequency of occurrence sufficiently, while serving at the same time as a sort of year and place index for the larger collections. From it he has been able to represent graphically the distribution of earthquakes over the three kingdoms by adopting conventional tints and marks to indicate extent of action and frequency of occurrence, the only factors which it is possible at present to so represent.

From this map it would appear that Great Britain has been much more subject to shocks than Ireland during the period embraced by the records. That as regards Ireland the points of more frequent action lie near the coast or on it ; that in Great Britain the south coast presents a number of points of activity situated approximatively on a same line, in all probability con-

[1] "Catalogue of Earthquakes having occurred in Great Britain and Ireland during Historical Time ; arranged relatively to Localities and Frequency of Occurrence, to serve as a Basis for an Earthquake Map of the three Kingdoms." With Map. By Jos. P. O'Reilly, C.E., Professor of Mining and Mineralogy, Royal College of Science, Dublin. (*Trans. Roy. I. Acad.*, vol. xxviii. ; *Science*, part xvii., September, 1884.)